

Ch 12 Mol Comp of Gases

Ch 11 in New

Volumes taken by gases \rightarrow reveals info about other props of gases

Dalton

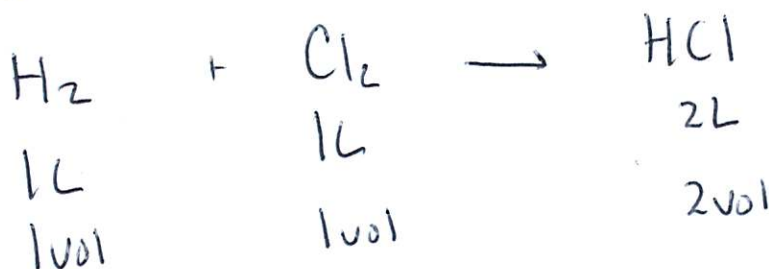
Measuring + Comparing Vol of Reactive Gases

Gay-Lussac

Saw



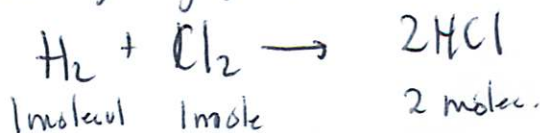
Also Saw



Gay-Lussac's Law of Combining vol - @ const T + P the V of gas reactants can be expressed as ratios of small whole #'s

Avogadro's hypothesis said \rightarrow equal Vol of gas @ same P + T have = # of molecules

\hookrightarrow rejected Dalton by saying elements are diatomic makes sense



HIM Wk on
Pg 3

Went
against
Dalton
but
didn't
know
 H_2
(atoms are
indivisible)

Atoms not
destroyed

1 mol of a gas has 6×10^{23} atoms or molecules

According to Avogadro's Principle - = Vol have same ~~the~~ molecules

Therefore 1 mol of any gas has same volume.

↳ This volume @ STP = 22.4 L

easier to measure mol of gas by Vol than mass

So $\frac{1 \text{ mol}}{22.4 \text{ L}}$ is a conversion factor convert to mol ~~know~~ figure mass out.

Example → p 346, 347

Gas Density → Varies w/ T + P why B/c V changes

↳ Temp must be stated.

$$D_{\text{STP}} = \frac{\text{molar mass}}{\text{molar volume}} = \frac{\text{g/mol}}{22.4 \text{ L/mol}} = \frac{\text{g}}{\text{mol}} \times \frac{\text{mol}}{22.4 \text{ L}} = \frac{\text{g}}{22.4 \text{ L}}$$

Q 348

Molar Mass @ STP from V

$$D_{STP} = \frac{\text{molar mass}}{\text{molar Vol}} \rightarrow \text{molar mass} = D_{STP} \times \text{mol Vol}$$

$$\frac{g}{L} \times \frac{22.4L}{\text{mol}}$$

Do prob 348-349

IDEAL GAS Eqn $PV = nRT \rightarrow$

Boyle's Law $V \propto \frac{1}{P}$
 Charles' $V \propto T$
 Gay-Lussac $P \propto T$

Avogadro $V \propto n$
 $V \propto \frac{1}{P} \times T \times n$
 Related by a const
 $P \propto \frac{1}{V} \times T \times n$

$$PV = nRT$$

$$R = 0.082 \frac{L \cdot atm}{mol \cdot K}$$

To use this
 Eqn V in L
 P in atm
 T in K

all prop ↑

$$\frac{PV}{RT} = R \text{ const!}$$

Ch 12 Q's p 350 q 6, 7

p 355 q 1, 3

p 360 q 1, 3, 4 H p 364 Q3

p 366 Q 1, 5, 7

p 367 Q 10, 11, 17, 20,

p 368 Q 31, App Prob

p 369 App Prob Q 22

Prob
 Hand Q 10, 11, 12 p 367
 18, 19 22

p 369 35, 37

Q 40, 364

Using Ideal gas Law

$PV = nRT \rightarrow$ can solve for any variable $PVnT$

\hookrightarrow make sure $V = L$, $T = K$, $P = atm$ b/c $R = 0.082 \frac{L \cdot atm}{mol \cdot K}$

Examples pg 352-353

Finding molar mass by ideal gas Law

$$mol = \frac{\cancel{\text{molar mass}} \cdot m}{\text{molar mass} \cdot M}$$

$$n = \frac{m}{M}$$

Substitute

$$PV = \frac{mRT}{M}$$

$$M = \frac{mRT}{PV}$$

$$\text{Density} = \frac{m}{V}$$

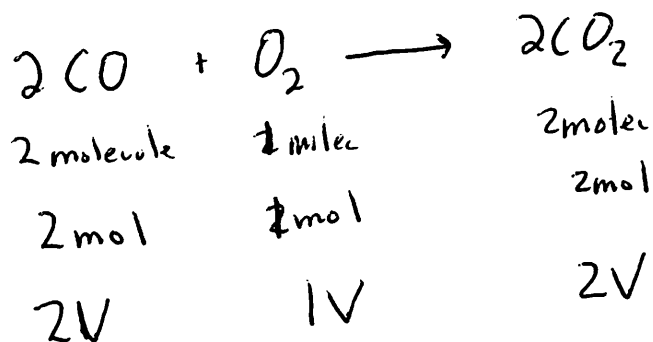
$$\rightarrow M = \frac{DRT}{P}$$

$$D = \frac{MP}{RT}$$

Examples p 355

Stoichiometry of Gases

Thanks to Gay-Lussac + Avogadro



Ratio examples

$$\frac{2 \text{ vol CO}}{1 \text{ vol O}_2} \text{ etc}$$

Vol-Vol Stoic

If 4 L of CO are used how much O₂ needed?

$$4 \text{ L CO} \times \frac{1 \text{ vol O}_2}{2 \text{ vol CO}_2} = 2 \text{ L O}_2$$

Not cut and dry mass \rightarrow Vol

Vol \rightarrow mass

process \rightarrow gas Vol A \rightarrow mol A \rightarrow mol B \rightarrow mass B

mass A \rightarrow mol A \rightarrow mol B \rightarrow Vol B

@STP $\frac{22.4 \text{ L}}{1 \text{ mol}}$ or use Ideal @ Non Standard

$$PV = nRT$$

Sample problem 359